# SECTION IV. THEORY OF OPERATION

13.4.1 **INTRODUCTION**

The Codex 3600 Series modem configured for ASOS operation is operated in one of two circuits: point-to-point or multipoint. The circuit varies from site to site. The ASOS point-to-point circuit uses a Premium Flex-cartridge and TURBO PP operating mode at a maximum transmission rate of 19.2 kbps or the V.33 operating mode at 14.4 kbps or 12 kbps. The ASOS multipoint circuit uses a Standard Flex-cartridge and multipoint-slave (MP-S) operating mode at a maximum transmission rate of 4.8 kbps. In either a point-to-point or multipoint circuit, ASOS responds to data requests (polls) from the Federal Aviation Administration (FAA) ADAS communications network with requisite data. Figure 13.4.1 illustrates the topology of the ADAS network.
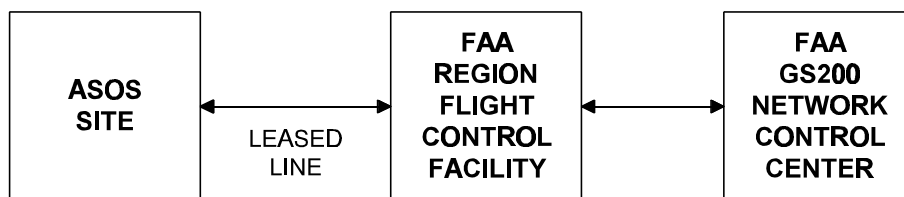
Figure 13.4.1. ADAS Network Topology

The Codex 3600 Series modem is transparent to ASOS. In either operating circuit, the local modem front panel can be controlled locally or from a remote 3600 modem on the ADAS network. The modem is normally under network control. The following chart summarizes the ASOS circuits and operating modes.

Circuit	Operating Mode	Max Transmission Rate	Flex-Cartridge (ASOS Site -Specific)
Point-to-point	TURBO PP	19.2 kbps	Premium
	V.33	14.4 kbps	Premium
	V.33	12.0 kbps	Premium
Multipoint	MP-S	9.6 kbps	Standard

Figure 13.4.2 illustrates the ASOS/ADAS point-to-point and multipoint connections.
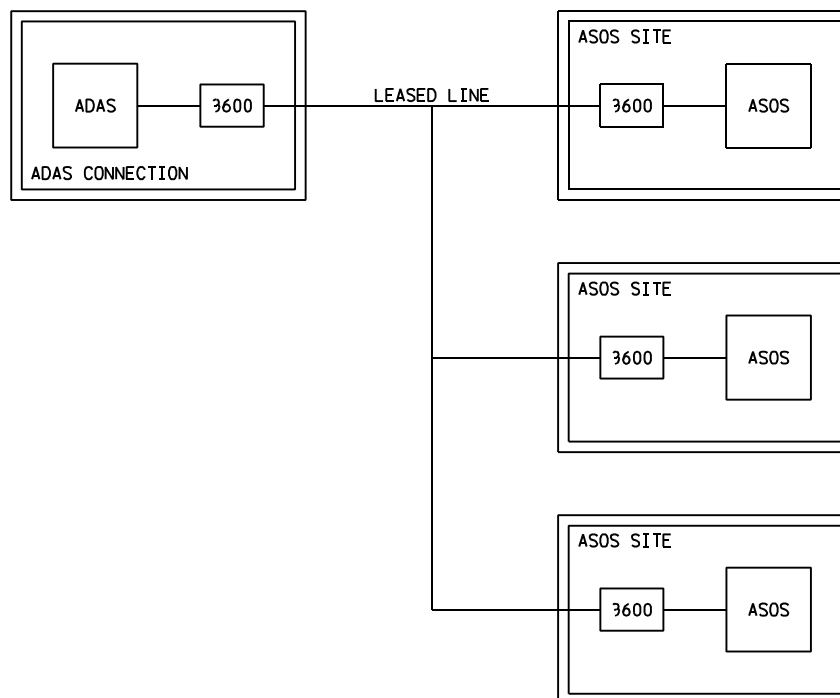
13.4.2 **TURBO POINT-TO-POINT AND V.33 COMMUNICATIONS**

The Codex 3600 Series modem configured for ASOS with a Premium Flex-cartridge uses the TURBO PP operating mode and a transmission speed of 19.2 kbps, enabling communications at a high performance level under a variety of operating conditions. TURBO PP supports transmission rates from 9.6 kbps to 24.0 kbps. A line probing feature automatically adjusts the carrier frequency and the baud rate of the modem to extract maximum performance from the communications line. To withstand high degrees of distortion at the transmission band edges, the TURBO PP operating mode uses a Codex proprietary technique called Trellis Precoding. The TURBO PP operating mode also uses an adaptive rate capability using the line probing feature with an adaptive rate system (ARS). Upon power up, line probing determines the highest possible data rate that current line conditions can support. Line probing then instructs the modem to run at that rate. The modem continually monitors its received error rate. As line conditions improve or deteriorate, the modem adjusts its speed and transmission band to provide the optimum throughput. The Codex 3600 Series modem uses a process called point-to-point training to initialize and synchronize point-to-point devices before transmission can begin. During training, the modem sends a predetermined training sequence.

Knowing how the training sequence should appear, the receiving device can recognize how specific line conditions have distorted the training pattern and compensate for the distortion using a technique known as equalization. Equalization is the reduction of the effects of attenuation or time delay or both on the various frequencies in the transmission band. The FAA may also utilize PP V.33 mode to improve reliability and HDLC recovery attempts in some circuits.
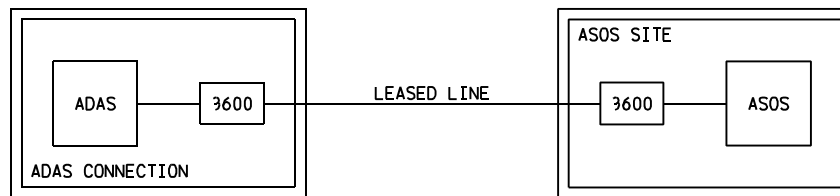
Figure 13.4.2. ASOS/ADAS Point-to-Point and Multipoint Connections

13.4.3 MULTIPOINT-SLAVE (MP-S) OPERATING MODE

The Codex 3600 Series modem configured for ASOS with a Standard Flex-cartridge uses the MP-S operating mode and a transmission speed of 9.6 kbps. The MP-S mode enables leased line operations at 4.8 kbps over unconditioned analog transmission lines. This mode of operation is used in a standard multipoint polling circuit. In the ASOS environment, the ASOS sites operating in the MP-S mode are slaves and the master 3600 modem is at an ADAS site. The MP-S mode enables asymmetrical operation so that the outbound rate can be configured differently from the inbound rate. In addition, the inbound rate from each slave is separately selectable using the mixed inbound rates (MIR) feature. The outbound direction uses a 253-ms training sequence, which enables the 3600 modem slaves to learn all significant channel characteristics. In the inbound direction, the master receiver has a very short training sequence (17 ms), which improves speed in responding to polls. Throughput in multipoint application is increased with training on data (TOD). TOD eliminates data-disruptive retrains by enabling slave devices to equalize on the data being transmitted. The elimination of retraining improves throughput and reduces response time in a multipoint circuit. Codex modems at ASOS sites are configured for 4.8 kbps.